COLORADO GEOLOGICAL SURVEY

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Karen Berry
State Geologist

March 25, 2015

Russell Forrest
Assistant County Manager for Economic and Community Development, and
Gunnison County Community Development Director
221 N. Wisconsin, Ste. D
Gunnison, CO 81230

Location:
Section 31,
T47N, R6W
of the N.M. Meridian
38.2853, -107.564

Subject: Cimarron Mountain Club (LUC 14-00028)
Gunnison County, CO; CGS Unique No. GU-15-0003

Dear Mr. Forrest:

Colorado Geological Survey has reviewed the Cimarron Mountain Club applicant's Minor Impact Land Use Change Permit submittal (Jim Aronstein, December 16, 2014). The geotechnical report included with the application (Johnston Geotecnical, revised September 25, 2014) is nearly identical to the one previously reviewed by CGS, with one additional recommendation on page 7, that "periodic inspection of the road be conducted with repair and maintenance as needed."

According to available geologic mapping (Dickinson, R.G., 1987, Geologic map of the Washboard Rock quadrangle, Gunnison, Montrose, and Ouray Counties, Colorado: U.S. Geological Survey, Geologic Quadrangle Map GQ-1643, scale 1:24,000), almost all of the Cimarron property is underlain by mapped landslide deposits. Google Earth imagery from June 3, 2014 (excerpt attached) shows several areas of severe road damage resulting from slope failures, and evidence of landslides and possible mudflows in other areas. CGS therefore has serious concerns about the stability of the slopes along the Cimarron access road, and about the applicant's ability to maintain access, including emergency access, to the proposed lots, especially during and after severe rainfall and snowmelt events.

I understand that you have requested that the applicant provide a stormwater plan for the entire length of the road, not just the 0.56-mile reconstructed section, along with information about any other problem areas with erosion or drainage on or adjacent to the road. CGS would like to review this information when available.

CGS recommends that the county also request a detailed geologic reconnaissance and subsurface exploration along the road, focusing on the reconstructed portion, to identify areas of potential instability, characterize slope stability conditions, and provide site-specific information and engineering parameters for designing slope stabilization and surface and subsurface drainage to minimize erosion and ensure long-term slope stability. This effort should include:

1. A detailed geologic reconnaissance, including field mapping and analysis of aerial imagery, of the road alignment to identify and map potential hazards including mudflows, landslides, shallow slumps or soil creep features, and other erosion features that could impact road stability. It will not be practical to perform the field reconnaissance until late spring or early summer when most of the snow has melted and surface features become more visible.

2. A topographic survey is needed to develop cross sections for use in the stability analyses and to provide topographic information about apparent and suspected slide features.

3. Drilling exploratory borings to characterize subsurface conditions, provide information on the engineering properties of overburden soils and underlying bedrock, identify potential failure planes within the surficial deposits and bedrock mass, and obtain samples for laboratory testing. Borings should be completed as piezometers for monitoring groundwater conditions. It is important to complete the borings and install the piezometers in the spring so that groundwater levels during and after the snowmelt period can be measured. The piezometers should be monitored on a weekly basis during and shortly after the snowmelt period and immediately after any storms, and on a less frequent basis thereafter. A qualified hydrogeologist should review the groundwater information to determine post-storm groundwater levels (a post-storm water level at least four feet higher than the highest measured groundwater level should be used in the stability analyses), estimate groundwater flows, and design surface and subsurface drainage.

4. Perform laboratory testing, including strength testing, for evaluating the shear strength and other engineering properties of the overburden soils and underlying bedrock material. In their Geotechnical and Geological Hazards Study, CMC Road (revised September 25, 2014), Johnston Geotecnical states (page 5), "Based on the subsurface soils encountered in the exploratory test holes, the remaining road width is excavated into the formational material and will likely not experience slope failure." CGS disagrees with Johnston's assumption that the "formational material" (bedrock?) is stable; based on the unusually long mapped landslide scarps within and surrounding the Cimarron property, there is *no* basis for assuming that the formational material or bedrock is inherently stable.

5. Perform local and global slope stability analyses, using site-specific, measured shear strength values and higher-than-observed water levels to reflect reasonable post-rainfall levels, to evaluate the stability of the existing slopes, determine whether slope monitoring (e.g. inclinometers) is needed, and to evaluate requirements for achieving and maintaining long-term slope stability with a factor of safety of at least 1.5.

6. Slope stabilization, if needed, should be designed to satisfy a permanent global slope stability factor of safety of at least 1.5. A qualified contractor specializing in the design and construction of slope stabilization should design the stabilization system(s), which may include ground anchors, horizontal drains, and/or other components. The geotechnical engineer should review the proposed stabilization system before implementation, and a representative of the geotechnical engineer should observe the installation. CGS agrees with Johnston that periodic inspection, maintenance, and repairs will be needed.

Avalanche hazard. The Snow Safety Analysis and Plan (Erik Larsen, October 25, 2014) refers to an Exhibit A, showing potential avalanche hazard areas. CGS would like to review this map, but it was not included in the posted version of Larsen's report.

Thank you for the opportunity to review and comment on this project. Colorado Geological Survey looks forward to reviewing the Stormwater plan, requested geologic information, stability analyses and, if needed, stabilization recommendations, and would like to be kept apprised of site characterization and monitoring activities and results. If you have questions or require further review, please call me at (303) 384-2643, or e-mail carlson@mines.edu.

Sincerely,

Jill Carlson, C.E.G.
Engineering Geologist

Cimarron Mountain Club
Landslide and slope failures on access road
Imagery date June 3, 2014
apparent landslide
shallow (?) slope failures
Google earth
N
600 ft